

Radiation damage in X-ray microscopy

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As with other forms of ionizing radiation, soft X-rays cause radiation damage which modifies materials via a wide range of mechanisms. In analytical X-ray microscopy bond breaking, bond creation and/or mass loss from radiation damage can lead to errors in chemical analysis. To avoid such artifacts it is important to quantify and characterize radiation damage in relevant systems – polymers, biological samples, etc. We have used scanning transmission X-ray microscopy (BL5.3.2) and X-ray photoemission electron microscopy (BL7.3.1) at the ALS to measure the rates of chemical transformation by radiation damage of a number of species, including polystyrene (PS), poly(methyl-methacrylate) (PMMA), and fibrinogen (Fg). NEXAFS spectroscopy of the damage product is used to gain insight into the chemical changes. The rates of radiation damage to polyethylene terephthalate (PET) by a TEM electron beam is compared to that caused by STXM. We are also exploring the potential of chemically selective X-ray lithography through patterned damage in polymer blends caused by differences in absorption coefficients or damage rates.

